IC ICM C30B029-06
CC 75-1 (Crystallography and Liquid Crystals)
Section cross-reference(s): 76
FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	JP 2001064095	A2	20010313	JP 1999-241185	19990827
PRAI	JP 1999-241185		19990827		

AB Claimed are Si wafers with N concn. (1 .times. 1014)-(4 .times. 1014) atoms/cm3 that are optimized for the max. effect of hydrogen annealing by which point defects are compensated.
ST defect recoverable **nitrogen doped silicon wafer**; annealing **Czochralski** silicon **wafer** defect compensation
IT Annealing
Czochralski crystal growth
Point defects
Semiconductor materials
(manuf. of **Czochralski** Si wafers with optimum N concn. for the max. annealing effects)
IT 1333-74-0, Hydrogen, uses
RL: NUU (Other use, unclassified); USES (Uses)
(annealing atm.; manuf. of **Czochralski** Si wafers with optimum N concn. for the max. annealing effects)
IT 7727-37-9, Nitrogen, uses
RL: MOA (Modifier or additive use); USES (Uses)
(manuf. of **Czochralski** Si wafers with optimum N concn. for the max. annealing effects)
IT 7440-21-3, Silicon, processes
RL: PEP (Physical, engineering or chemical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)
(semiconductive, N-doped; manuf. of **Czochralski** Si wafers with optimum N concn. for the max. annealing effects)

L5 ANSWER 35 OF 44 CAPLUS COPYRIGHT 2003 ACS
AN 2000:694251 CAPLUS
DN 133:274477
TI **Czochralski** growth of silicon single crystal, silicon **wafer**, and estimation of nitrogen dopant concentration
IN Asayama, Eiichi; Umeno, Shigeru; Hohrai, Masataka
PA Sumitomo Metal Industries, Ltd., Japan
SO Jpn. Kokai Tokkyo Koho, 8 pp.
CODEN: JKXXAF
DT Patent
LA Japanese
IC ICM C30B029-06
ICS C30B015-00; H01L021-324; H01L021-66
CC 75-1 (Crystallography and Liquid Crystals)
Section cross-reference(s): 76
FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	JP 2000272997	A2	20001003	JP 1999-83882	19990326
PRAI	JP 1999-83882		19990326		

AB A method for growing a silicon single crystal by a **Czochralski** method involves doping the single crystal with N so that an OSF region .gtoreq.103 cm-2 would be formed on the overall surface of a **wafer** cut from the single crystal. Addnl., the **wafer** may have oxygen-pptn. and oxygen-pptn. prevention regions. The formation of grown-in defects is prevented. A nm for estg. the concn. of the N dopant involves detg. the d. of OSF.
ST **Czochralski** growth **silicon nitrogen doping**
IT **Czochralski** crystal growth
Dopants
Doping
Stacking faults

L5 ANSWER 16 OF 44 CAPLUS COPYRIGHT 2003 ACS
AN 2002:241140 CAPLUS
DN 136:255640
TI Method of producing silicon **wafer**, and silicon **wafer**
IN Tamatsuka, Masaro; Qu, Wei Feig; Kobayashi, Norihiro
PA Shin-Etsu Handotai Co., Ltd., Japan
SO PCT Int. Appl., 26 pp.
CODEN: PIXXD2
DT Patent
LA Japanese
IC ICM H01L021-322
CC 76-2 (Electric Phenomena)
FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	WO 2002025716	A1	20020328	WO 2001-JP8005	20010914
	W: KR, SG, US				
	RW: AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR				
	JP 2002100632	A2	20020405	JP 2000-286068	20000920
PRAI	JP 2000-286068	A	20000920		

AB The invention relates to a method of producing a silicon **wafer** comprising the steps of growing a **nitrogen-doped silicon** single-crystal bar having a resistivity of at least 100 .OMEGA..cm and an initial interstitial oxygen concn. of 10-25 ppm-a by a **CZ** method, processing the silicon single-crystal bar into a **wafer**, and heat-treating the **wafer** to thereby reduce a residual interstitial oxygen concn. in the **wafer** to up to 8 ppm-a; and a method of producing silicon **wafer** comprising the steps of growing a **nitrogen-doped silicon** single-crystal bar having a resistivity of at least 100 .OMEGA..cm and an initial interstitial oxygen concn. of up to 8 ppm-a by a **CZ** method, processing the silicon single-crystal bar into a **wafer**, and heat-treating the **wafer** to thereby form an oxygen deposition layer on a **wafer** bulk unit; and a silicon **wafer** produced by these prodn. methods, whereby forming a high-quality DZ layer and pos. providing a DZ-IG **wafer** capable retaining a high resistivity despite a device prodn. heat treating.
ST **Czochralski** crystal growth silicon **wafer**
IT **Czochralski** crystal growth
(**Czochralski** crystal growth process for silicon **wafer**
)
IT 7440-21-3, Silicon, processes
RL: EPR (Engineering process); PEP (Physical, engineering or chemical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)
(**Czochralski** crystal growth process for silicon **wafer**
)
RE.CNT 16 THERE ARE 16 CITED REFERENCES AVAILABLE FOR THIS RECORD
RE

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L5 ANSWER 27 OF 44 CAPLUS COPYRIGHT 2003 ACS
AN 2001:531893 CAPLUS
DN 135:114686
TI Silicon single crystal ingot, manufacture of the ingot by **Czochralski** method, and manufacture of silicon **wafer**
IN Minami, Toshiro; Hirano, Yumiko
PA Toshiba Ceramics Co., Ltd., Japan
SO Jpn. Kokai Tokkyo Koho, 9 pp.
CODEN: JKXXAF
DT Patent
LA Japanese
IC ICM C30B029-06
ICS C30B029-06; C30B015-04; H01L021-02; H01L021-208; H01L021-304
CC 75-1 (Crystallography and Liquid Crystals)
Section cross-reference(s): 76
FAN.CNT 2

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	JP 2001199794	A2	20010724	JP 2000-8007	20000117
	US 2001029883	A1	20011018	US 2001-760713	20010117
	US 6517632	B2	20030211		
PRAI	JP 2000-8007	A	20000117		
	JP 2000-98115	A	20000331		

AB The Si ingot is that prepd. by the claimed **Czochralski** method using a melt made of polycryst. Si doped with 1 .times. 1013-5 .times. 1015 atom/cm3 N and 5 .times. 1015-3 .times. 1016 atom/cm3 C for obtaining the ingot with the dopant concns. similar to those in the melt. The Si **wafer** is manufd. by slicing the obtained ingot and (a) heating for forming crystal defects as getters or (b) polishing and etching for forming the mirror surface with .ltoreq.2/cm2 d. of .gtoreq.0.11-.mu.m etch pit and max. etch pit size .ltoreq.0.15 .mu.m. The **wafer** provides a semiconductor device showing good voltage resistance on oxide capacitor films.
ST silicon single crystal ingot **Czochraiski** method; **nitrogen** carbon **doped silicon** semiconductor **wafer**; getter heating doped silicon **wafer** semiconductor; polishing etching doped silicon **wafer**; oxide capacitor voltage resistance semiconductor device
IT Etching
Polishing
(**Czochralski** crystal growth for forming carbon- and **nitrogen-doped silicon** followed by)
IT Getters
(**Czochralski** crystal growth for forming carbon- and **nitrogen-doped silicon** followed by heating for forming)
IT **Czochralski** crystal growth
Semiconductor devices
(**Czochralski** crystal growth for forming carbon- and **nitrogen-doped silicon** for semiconductor device)
IT 7440-21-3, Silicon, properties
RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PRP (Properties); PROC (Process); USES (Uses)
(**Czochralski** crystal growth for forming carbon- and **nitrogen-doped silicon** for semiconductor device)
IT 7440-44-0, Carbon, uses 7727-37-9, Nitrogen, uses
RL: MOA (Modifier or additive use); USES (Uses)
(**Czochralski** crystal growth for forming carbon- and **nitrogen-doped silicon** for semiconductor device)
IT 7664-41-7, Ammonia, uses 7722-84-1, Hydrogen peroxide, uses 7732-18-5, Water, uses
RL: NUU (Other use, unclassified); USES (Uses)
(etchant; **Czochralski** crystal growth for forming carbon- and

(**Czochralski** growth of silicon single crystal, silicon **wafer**, and estn. of nitrogen dopant concn.)
IT 7727-37-9, Nitrogen, uses
RL: MOA (Modifier or additive use); USES (Uses)
(**Czochralski** growth of silicon single crystal, silicon **wafer**, and estn. of nitrogen dopant concn.)
IT 7440-21-3, Silicon, properties
RL: PEP (Physical, engineering or chemical process); PRP (Properties); PROC (Process)
(**Czochralski** growth of silicon single crystal, silicon **wafer**, and estn. of nitrogen dopant concn.)

L5 ANSWER 39 OF 44 CAPLUS COPYRIGHT 2003 ACS
AN 1999:802752 CAPLUS
DN 132:29052
TI Nitrogen-doped and low-defect silicon single crystal **wafer** and its production by **Czochralski** method
IN Iida, Makoto; Tamazuka, Masaro; Kimura, Masaki; Muraoka, Shozo
PA Shinetsu Handotai Co., Ltd., Japan
SO Jpn. Kokai Tokkyo Koho, 11 pp.
CODEN: JKXXAF
DT Patent
LA Japanese
IC ICM C30B015-04
ICS C30B029-06; H01L021-02; H01L021-322
CC 75-1 (Crystallography and Liquid Crystals)
Section cross-reference(s): 76
FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	JP 11349394	A2	19991221	JP 1998-172274	19980604
PRAI	JP 1998-172274		19980604		

AB A **nitrogen-doped silicon** single crystal **wafer** grown by a **Czochralski** method is free of dislocation clusters although there are excess interstitial Si on the crystal surface. A method for growing the above single crystal by a **Czochralski** method is also described.
ST **nitrogen doped silicon Czochralski** crystal growth
IT **Czochralski** crystal growth
(nitrogen-doped and low-defect silicon single crystal **wafer** and prodn. by **Czochralski** method)
IT 7727-37-9, Nitrogen, uses
RL: MOA (Modifier or additive use); USES (Uses)
(nitrogen-doped and low-defect silicon single crystal **wafer** and prodn. by **Czochralski** method)
IT 7440-21-3, **Silicon**, processes
RL: PEP (Physical, engineering or chemical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)
(**nitrogen-doped** and low-defect silicon single crystal **wafer** and prodn. by **Czochralski** method)

L5 ANSWER 42 OF 44 CAPLUS COPYRIGHT 2003 ACS
AN 1999:415999 CAPLUS
DN 131:137304
TI High-performance silicon wafers with wide grown-in void-free zone and high-density internal gettering site achieved via rapid crystal growth with nitrogen doping and high-temperature hydrogen and/or argon annealing
AU Tamatsuka, Masaro; Kobayashi, Norihiro; Tobe, Satoshi; Masui, Tumoru
CS Material Science Department of SEH Isobe R&D Center, Shin-Etsu Handotai Co., Ltd., Annaka, 379-0199, Japan
SO Proceedings - Electrochemical Society (1999), 99-1(Defects in Silicon), 456-467
CODEN: PESODO; ISSN: 0161-6374
PB Electrochemical Society
DT Journal
LA English

CC 76-3 (Electric Phenomena)
AB Grown-in voids annihilation phenomena due to high temp. hydrogen and argon annealing have been investigated for a **nitrogen-doped Czochralski silicon** substrate. Grown-in voids can be annihilated up to 2-10 .mu.m depending on the initial oxygen concn. in the nitrogen-doped substrate, while they can still exist at 0-2 .mu.m depth in a non-nitrogen-doped substrate. This annihilation efficiency strongly depends on the initial void size and oxygen concn. The combination of rapid growth and nitrogen doping is best to achieve smaller voids so as to deepen the void-free zone. In addn., in the same growth rate crystal, the lower the initial oxygen concn. the deeper the void-free zone. A model based on point-defect injection and out-diffusion is proposed to explain the dependence of void annihilation depth on initial oxygen concn. and void size. The simulation results are quant. consistent with the exptl. results. This is the first report revealing the dependence of grown-in void annihilation depth on the oxygen concn. in a **nitrogen-doped Czochralski silicon** substrate.
ST **Czochralski** crystal growth silicon **wafer**; void free zone **Czochralski** silicon **wafer**; gettering **Czochralski** silicon **wafer**
IT **Czochralski** crystal growth
Gettering
(high-performance Si wafers with high-d. internal gettering site achieved via rapid crystal growth and high-temp. annealing)
IT 7440-21-3, Silicon, properties
RL: FMU (Formation, unclassified); PEP (Physical, engineering or chemical process); PRP (Properties); FORM (Formation, nonpreparative); PROC (Process)
(wafers; high-performance silicon wafers with wide grown-in void-free zone achieved via rapid crystal growth and high-temp. annealing)
RE.CNT 28 THERE ARE 28 CITED REFERENCES AVAILABLE FOR THIS RECORD
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nitrogen-doped silicon followed by etching)

L5 ANSWER 33 OF 44 CAPLUS COPYRIGHT 2003 ACS
AN 2001:270378 CAPLUS
DN 134:288183
TI Epitaxy on defect-minimized and **nitrogen-doped Czochralski silicon** wafers
IN Asayama, Eiichi; Umeno, Shigeru; Horai, Masataka
PA Sumitomo Metal Industries, Ltd., Japan
SO Jpn. Kokai Tokkyo Koho, 8 pp.
CODEN: JKXXAF
DT Patent
LA Japanese
IC ICM C30B029-06
ICS C30B025-02
CC 75-1 (Crystallography and Liquid Crystals)
Section cross-reference(s): 76
FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	JP 2001106594	A2	20010417	JP 1999-286586	19991007
	US 6365461	B1	20020402	US 2000-679888	20001005
PRAI	JP 1999-286586	A	19991007		

AB The epitaxy is carried out on N-doped Si single-crystal wafers with O concn. .ltoreq.9 .times. 1017 atoms/cm3 in O-induced stacking fault (OSF) ring regions. The wafers may be sliced out from N-doped **Czochralski** ingots where the OSF rings appear .gtoreq.85% (from the center) radius position. The ingots may be doped with (1 .times. 1012) - (1 .times. 1014)-atoms/cm3 N and may be withdrawn at .gtoreq.1.2 mm/min. The as-sliced wafers may be annealed at 1200-1300.degree. for .gtoreq.1 min. The process minimizes dislocations or stacking faults in the epi layers without decreasing O ppts. which work as impurity getters.
ST silicon epitaxy dislocation fault minimized; **nitrogen doped silicon wafer** epitaxy; OSF location controlled silicon **wafer** epitaxy; annealed silicon **wafer** epitaxy
IT Stacking faults
(O-induced; epitaxy on defect-minimized and N-doped Si wafers with minimized OSF concn.)
IT Annealing
Czochralski crystal growth
Epitaxy
Semiconductor materials
(epitaxy on defect-minimized and N-doped Si wafers with minimized OSF concn.)
IT 7440-21-3, Silicon, processes
RL: PEP (Physical, engineering or chemical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)
(N-doped; epitaxy on defect-minimized and N-doped Si wafers with minimized OSF concn.)
IT 7727-37-9, Nitrogen, processes 7782-44-7, Oxygen, processes
RL: MOA (Modifier or additive use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)
(epitaxy on defect-minimized and N-doped Si wafers with minimized OSF concn.)

L5 ANSWER 34 OF 44 CAPLUS COPYRIGHT 2003 ACS
AN 2001:174027 CAPLUS
DN 134:215172
TI Manufacture of **nitrogen-doped Czochralski silicon** wafers containing size-reduced point defects
IN Komiya, Satoshi; Yoshino, Shiro; Danbata, Masayoshi; Hayashida, Koichiro
PA Komatsu Denshi Kinzoku K. K., Japan
SO Jpn. Kokai Tokkyo Koho, 6 pp.
CODEN: JKXXAF
DT Patent
LA Japanese